The invention in which an exclusive right is claimed is defined by the following:

1. A bending die for use in sheet metal forming, comprising:

(a) a first working surface extending longitudinally relative to a longitudinal axis of the bending die;

(b) a second working surface extending longitudinally relative to the longitudinal axis of the bending die and disposed adjacent to said first working surface; and

(c) a frame configured to provide support for said first and second working surfaces, while enabling said first and second working surfaces to move relative to the frame, such that a substantially fixed separation between adjacent edges of the first and second working surfaces is maintained, regardless of a rotational angular displacement of either of the first and second working surfaces.

2. The bending die of Claim 1, wherein said adjacent edges of said first and second working surfaces are separated by a gap having a predefined width, said gap affecting a configuration of the sheet metal formed with the bending die.

3. The bending die of Claim 1, wherein the adjacent edges of said first and second working surfaces substantially abut one another.

4. The bending die of Claim 1, wherein said frame comprises a first section and a second section, a position of said first section relative to said second section being adjustable to enable a width of a gap separating the adjacent edges of said first and second working surfaces to be adjusted to a desired dimension.

5. The bending die of Claim 1, wherein for each working surface:

(a) a center of rotation is associated with the working surface;

(b) relative to a portion of the working surface that is in contact with the metal sheet during metal forming, the center of rotation is disposed proximate to an inner edge of said portion; and

(c) regardless of the rotational angular displacement of the working surface, the center of rotation remains substantially fixed.

6. The bending die of Claim 1, further comprising a hinge assembly disposed at each end of the first and second working surfaces, each hinge assembly pivotally coupling said first and second working surfaces together, such that a rotational displacement of one of said first and second working surfaces results in a corresponding rotational displacement of the other one of said first and second working surfaces, through an opposite rotational direction.

7. The bending die of Claim 6, wherein at least one hinge assembly includes a return spring that applies a restoring force to return said first and second working surfaces to their respective original positions after the sheet metal has been deformed in the bending die, and after a force is no longer applied to deform the sheet metal and the sheet metal has been removed from the bending die.

8. The bending die of Claim 6, wherein each hinge assembly comprises a pair of sector gears, and a pair of rack gears that are mounted on the frame, each sector gear engaging a different rack gear and being mounted at an end of different ones of the first and second working surfaces.

9. The bending die of Claim 8, wherein said frame includes a generally U-shaped portion defined by support members disposed adjacent to the end of one of the first and second working surfaces, such that each rack gear is attached to a different support member.

10. The bending die of Claim 6, wherein said first and second working surfaces are each generally rectangular in shape.

11. The bending die of Claim 6, wherein each hinge assembly further comprises a first link and a second link joined by a pivot shaft, the first link being coupled to one sector gear, and the second link being coupled to another sector gear.

12. The bending die of Claim 1, wherein each of said first and second working surfaces comprises an angled upper surface having a shape selected to facilitate over-bending of the sheet metal.

13. The bending die of Claim 1, further comprising a resist element that applies a resisting force to said first and second working surfaces, the resisting force countering at least in part a force applied to deform the sheet metal.

14. The bending die of Claim 13, wherein the resist element comprises at least one of a stripper, a spring, an elastomeric material, a hydraulic component, a collapsible support, a movable support, and a pneumatic component.

15. The bending die of Claim 13, wherein said resist element comprises:

(a) a channel, said channel having a dimension substantially equal to said fixed separation;

(b) an elongate block partially disposed in said channel, said elongate block having a dimension smaller than said fixed separation; and

(c) a spring disposed in said channel so as to apply a restoring force against said elongate block in opposition to a deformation of the metal sheet into the channel, such that said elongate block is returned to an original position after the metal sheet is removed following the deformation of the metal sheet.

16. The bending die of Claim 1, further comprising a sector gear coupled to each one of said first and second working surfaces.

17. The bending die of Claim 16, further comprising a prime mover, and a plurality of driven gears configured to drivingly couple with the prime mover, each driven gear being disposed to engage one of said sector gears, such that as each driven gear is rotated, the corresponding sector gear is rotated.

18. The bending die of Claim 17, further comprising a plurality of shafts, such that each driven gear is coupled to one of said plurality of shafts.

19. The bending die of Claim 16, wherein said frame comprises a plurality of rack gears, such that each sector gear engages a different rack gear.

20. The bending die of Claim 1, wherein each of said first and second working surfaces comprises an elongate sector gear, and wherein said frame comprises opposed rack gears, such that the elongate sector gear on each one of said first and second working surfaces engages a different rack gear.

21. The bending die of Claim 1, further comprising a piston and a cylinder assembly disposed adjacent to each of said first and second working surfaces, such that each one of said first and second working surfaces is coupled to a different piston and cylinder assembly, each piston and cylinder assembly applying one of a driving force and a resisting force to a different one of the first and second working surfaces.

22. The bending die of Claim 21, wherein each of said first and second working surfaces comprises a wing, such that each wing in coupled to a different piston and cylinder assembly.

23. The bending die of Claim 21, wherein each piston and cylinder assembly comprises one of a hydraulic system, a pneumatic system, and a mechanical system.

24. The bending die of Claim 21, wherein each piston and cylinder assembly is coupled to an actuator that controls a movement of said first and second working surfaces.

25. A press brake for use in sheet metal forming, comprising:

(a) a first die extending longitudinally relative to a longitudinal axis of the press brake, said first die including a working surface configured to support a work piece, said working surface having an inner edge and an outer edge;

(b) a second die extending longitudinally relative to the longitudinal axis of the press brake and disposed adjacent to said first die, said second die including a working surface configured to support a work piece, said working surface having an inner edge and an outer edge; and

(c) a frame coupled to and supporting said first and second dies, while enabling said first and second dies to move relative to the frame, such that each die is able to rotate about a different respective center of rotation, and so that regardless of an rotational angular displacement of the die relative to the frame, the inner edge of the die is disposed closer to the respective center of rotation of the die than the outer edge of the die.

26. The press brake of Claim 25, wherein a substantially fixed separation is maintained between adjacent inner edges of the first and second dies, regardless of the rotational angular displacement of either one of the first and second dies about its respective center of rotation.

27. The press brake of Claim 26, wherein said frame is adjustable, so that said substantially fixed separation can be adjusted to a desired dimension, the desired dimension being substantially maintained regardless of the rotational angular displacement of either of the first and second dies.

28. The press brake of Claim 25, further comprising at least one spring operatively coupled to at least one of the first and the second dies, producing a restoring force that acts to return said first die and said second die to respective original positions, after they have been rotatably displaced.

29. The press brake of Claim 25, further comprising a hinge assembly disposed at each end of the first and second dies, said hinge assemblies pivotally coupling said first and second dies together, such that a displacement of one of said first and second dies results in a corresponding displacement of the other of said first and second dies.

30. The press brake of Claim 29, wherein each hinge assembly comprises a pair of sector gears, and a pair of rack gears mounted on the frame, each sector gear engaging a different rack gear and being mounted at an end of different ones of the first and second dies.

31. The press brake of Claim 25, wherein each of said first and second dies comprises an elongate sector gear, and wherein said frame comprises opposed rack gears, each elongate sector gear of said first and second dies engaging a different rack gear.

32. The press brake of Claim 25, further comprising means for applying a force to each of said first and second dies, the force being applied for one of:

(a) countering at least in part a force applied to deform the sheet metal; and

(b) causing the rotational angular displacement of said first and second dies, in order to achieve a desired deformation of the sheet metal.

33. The press brake of Claim 32, wherein each of said first and second dies comprising a wing, each wing being coupled to said means for applying a force.

34. The press brake of Claim 32, wherein said means comprises one of a spring, an elastomeric material, a hydraulic system, and a pneumatic system.

35. The press brake of Claim 32, wherein each of said first and second dies comprises a sector gear, and wherein said means comprises a prime mover and a plurality of driven gears that are drivingly coupled with the prime mover, to drivingly rotate the sector gear of each of said first and second dies.

36. The press brake of Claim 25, wherein each of said first and second dies comprises a sector gear, and said frame comprises a rack gear configured to engage each of said first and second dies.

37. A press brake for use in sheet metal forming, the press brake being adapted for use with a punch tool, said press brake comprising:

(a) a frame;

(b) a plurality of rack gears and a corresponding plurality of sector gears, each rack gear being attached to said frame in engagement with a different sector gear; and

(c) a first plate die and a second plate die, each of the first plate die and the second plate die having opposite ends, each end of the first plate die and the second plate die being attached to a different sector gear so that:

(i) a rotational displacement of one of said first and second plate dies results in a corresponding rotational displacement of the other of said first and second plate dies; and

(ii) a separation between adjacent edges of the first plate die and the second plate die remains substantially constant as the first and the second plate dies are rotatably displaced, wherein the first plate die and the second plate die have upper surface adapted to support a work piece as a punch forming tool deforms the work piece when rotatably displacing the first plate die and the second plate die.

38. A bending die for use in sheet metal forming, comprising:

(a) a first working surface extending longitudinally relative to a longitudinal axis of the bending die;

(b) a second working surface extending longitudinally relative to the longitudinal axis of the bending die and disposed adjacent to said first working surface;

(c) a hinge assembly disposed at each end of the first and second working surfaces, said hinge assemblies pivotally coupling said first and second working surfaces together, so that a rotational displacement of one of said first and second working surfaces results in a corresponding rotational displacement of the other one of said first and second working surfaces; and

(d) a frame that supportingly engages each hinge assembly, so that a rotational displacement of either of the first and second working surfaces produces a rotation displacement of the first and second working surfaces in opposite directions, while maintaining a substantially fixed separation between adjacent edges of the first and second working surfaces.

39. A method for forming a work piece, comprising the steps of:

(a) providing adjacent longitudinally extending, rotatable support surfaces;

(b) positioning the work piece on the rotatable support surfaces; and

(c) applying a deforming force to the work piece, causing the rotatable support surfaces to rotate in opposite directions in response to the deforming force, while maintaining a substantially fixed separation between adjacent edges of the rotatable support surfaces as they are rotatably displaced, said work piece being supported by the rotatable support surfaces when deformed by the deforming force into a desired shape.

40. The method of Claim 39, further comprising the step of restoring the rotatable support surfaces to an original position after the deforming force and the work piece are removed.

41. The method of Claim 39, wherein the step of maintaining the substantially fixed separation comprises the step of coupling the rotatable support surfaces to a framework with gears that constrain a rotatable displacement of the rotatable support surfaces so that a width of a gap between the adjacent edges of the rotatable support surfaces remains substantially fixed.

42. A method for forming a work piece, comprising the steps of:

(a) providing adjacent longitudinally extending, rotatable support surfaces, each support surface including a portion configured to contact the work piece, each portion having an inner edge and an outer edge;

(b) positioning the work piece on the rotatable support surfaces; and

(c) applying a deforming force that causes the rotatable support surfaces to rotate about different respective centers of rotation, so that for each support surface, regardless of a rotational angular displacement of the support surface about its respective center of rotation, the center of rotation remains fixed, and so that the inner edge of the portion is disposed closer to the center of rotation than the outer edge of the portion.

43. The method of Claim 42, wherein the step of applying a deforming force comprises the step of apply the deforming force to the work piece with an upper tool that contacts the work piece, such that the rotatable support surfaces rotatably move in response to the deforming force applied by the upper tool against the work piece.

44. The method of Claim 42, wherein the step of applying a deforming force to the work piece comprises the step of applying the deforming force to the rotatable support surfaces, such that the rotatable support surfaces apply the deforming force to the work piece, while an upper tool provides support for the work piece.

45. A method for forming a channel in sheet metal using a press brake, comprising the steps of:

(a) providing a tool that supports the sheet metal as a deforming force is applied to the sheet metal, said tool including elongate support surfaces disposed adjacent to each other;

(b) positioning the sheet metal on the adjacent elongate support surfaces of the tool, such that the sheet metal overlies a gap formed between adjacent edges of the elongate support surfaces; and

(c) applying a deforming force to the sheet metal, directed toward the gap, causing the elongate support surfaces of the tool to rotate in opposite directions, while maintaining a substantially fixed separation between adjacent edges of the support surfaces, so that the sheet metal is formed into a channel defined by the adjacent edges of the elongate support surfaces.

46. The method of Claim 45, further comprising the step of applying an opposing force to a block disposed within the gap, in a direction opposite to that of the deforming force, said opposing force supporting the sheet metal as the channel is formed in the sheet metal by the deforming force.